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Article

Analysis of Benefits to Young Rail Enthusiasts of Participating in Extracurricular Academic Activities

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Abstract: The paper examines a number of positive academic outcomes achieved by university students who, as young rail enthusiasts representing over 10 European institutions, took part in extracurricular rail-related academic activities. Analyses presented in the paper are based on the evaluation of the responses to the questionnaire distributed amongst participants of three consecutive editions of an intensive program in rail and logistics which took place in 2012, 2013, and 2014. Also, quotes from follow-up one-to-one interviews with participants are used to support the results presented. The sample for each year varies in terms of numbers, nationalities, academic backgrounds, and male:female ratio. Academic benefits are specifically looked into, which includes teaching and learning activities throughout the three weeks of the program. The analysis of results revealed that young rail enthusiasts who participated in the program benefited from lectures delivered in Week 1, especially those focused on multimodal transport and rail infrastructure in 2013, which received positive mean ratings of 4.45 and 4.53, respectively, on a five-point Likert scale. Moreover, academic benefits were strongly supported by non-technical skills improvements in areas such as English language and communication, both reaching the mean ratings of 4.35 or above in 2014. A number of recommendations for improvements of next editions of similar rail-related programs as well as areas for future research are identified in the paper.

Keywords: academic activities; rail curriculum; intensive program; evaluation; benefits

1. Introduction

With the increasing number of large-scale infrastructure rail projects around the globe (e.g., the Thameslink Program in the UK; a driverless Riyadh metro in Saudi Arabia; a driverless metro in Sydney, Australia) and variety of new emerging technologies (e.g., drones, intelligent robots, new energy solutions [1] being implemented to the rail sector), the railways are in their renaissance age again. Although the picture of the railway sector from investment's perspective is positive, predicted shortages in skilled rail engineering workforce, caused mainly by the skills gap and retirement age [2,3], have already been highlighted by the industry. An effective recruitment of the best workforce will play a crucial role in a successful delivery of the planned projects as well as in the sustainable expansion of railways.

In order to address this skills gap in the railway sector, a number of industry and academia-led initiatives have already been initiated around the world. New rail training academies are opening worldwide (e.g., Saudi Railway Polytechnic in Saudi Arabia, Rail Academy in the UK) and more universities are offering railway programs at undergraduate, postgraduate, or doctoral level (e.g., Rail Vehicle Dynamics course at Royal Institute of Technology in Sweden, MSc in Railway System Engineering at Technische Universität Dresden in Germany, a postgraduate course in Railway Infrastructure and Systems Engineering at Sapienza Università di Roma in Italy). Moreover, extracurricular activities such as summer schools, residential programs, competitions, *etc.* are taking place more often and attract pre-university as well as university-age students. For example, Michigan Tech has so far delivered six editions of one-week, free "Rail and Intermodal Transportation Summer Youth Programs" addressed to pre-university students in the USA. The Australasian Railway Association is involved in organizing "Rail Careers Week", which is a country-wide campaign aimed at promoting various rail careers in the Australian industry and, most importantly, raising awareness about the career opportunities among school leavers and people interested in changing their careers as well as the general public. In the UK an intensive program in rail and logistics attracted European Commission funding and has been delivered for three consecutive years (2012–2014), involving over 150 university students, mainly Europeans.

The interest in extracurricular academic activities with a rail flavor is growing among students as the industry is multidisciplinary and needs people from various STEM (science, technology, engineering, math) and non-STEM backgrounds (e.g., human resources, business, psychology). However, the benefits to young rail enthusiasts of participating in such activities and the impact this can have on their careers have not been widely published. This paper aims to address this gap by presenting an evaluation of benefits to students participating in one of the rail-focused initiatives, an intensive program in rail and logistics.

2. Background

This paper examines the academic outcomes of an intensive program in rail and logistics, the teaching and learning methods used, and the feedback related to academic activities received from young rail enthusiasts participating in the program in 2012, 2013, and 2014. The young rail enthusiasts were

students from over 10 higher education institutions (HEIs), mainly from Europe, who at their home universities studied various subjects linked to rail and transport (e.g., Telematics and Electronics for Transport at the Romanian HEI, Supply Chain Management and Sales at the Greek HEI, or Civil Engineering at the Turkish HEI).

The program, funded by the Lifelong Learning Program of the European Commission, addressed two main objectives of the ERASMUS SUB-programs: firstly, "to improve the quality and to increase the volume of student and teaching staff mobility throughout Europe" (ERA-OpObj-1) [4]; and, secondly, "to improve the quality and to increase the volume of multilateral cooperation between higher education institutions in Europe" (ERA-OpObj-2) [4]. More specifically, the aim of the program was to focus on improving the quality of railway and logistics higher education as well as on increasing the volume of the students and teaching staff mobility between the HEIs involved in the project.

The evaluated program was unique as it offered students a blended approach to teaching and learning about the railways and employed research-based learning [5]. The program used a range of educational tools, such as lectures, seminars, group work, research projects, technical visits, workshops, and networking events, to teach participants the principles of railways and to encourage their development in the academic as well as personal sphere [6].

The first edition of the three-week long program took place in 2012 and was then repeated in a similar form twice in 2013 and 2014. Each edition attracted over 40 participants, the majority being undergraduate and postgraduate students from European HEIs partnering in the delivery of the program. The HEIs participating in the program varied slightly each year, mainly due to the personal circumstances of staff involved, but overall they represented 10 European Union countries including old members (Belgium, Germany, Greece, Italy, Portugal, the UK) and new member states (Bulgaria, Poland, Romania), as well as Turkey.

The main purpose of the program was to facilitate and improve the exchange of railway knowledge between the new and old member states' HEIs by exercising staff and students' mobility with a ratio of approximately six students to one staff member per institution. Moreover, the program offered a great opportunity for multidisciplinary learning with students from various backgrounds (engineering, humanities, *etc*.) studying and researching railways together for the benefit of the railway sector of the future [7].

Each of the three editions of the program evaluated in the paper ended with a student survey completed by all participants. The survey focused on students' academic and personal benefits gained from the program. Analyses of the results related to the academic outcomes are presented in this paper. Other results related to the structure and organization of the program [6] and its personal impact and outcomes [8] are analyzed in other publications.

3. Organization of the Program

Although the actual curriculum of the intensive program in rail and logistics varied slightly each year, due to changes of HEIs involved in the project, the overall teaching and learning methods used in each of the three editions of the program remained the same [9]. The program's activities spanned over three weeks with lectures in Week 1, research work in Week 2, and technical visits and thematic seminars in Week 3. Also, as the program involved students from various engineering and non-engineering

backgrounds, the academic level of the program was basic in order to include all participants in active discussions and research projects.

Teaching activities in Week 1 began with five lectures per day (see Table 1), 45 min each. Railway professors and railway experts representing various European academic and industry institutions delivered the lectures. Each day of Week 1 was dedicated to a different theme, including: Logistics and Supply Chain Management; Multimodal Transport; Rail Infrastructure, High Speed and IT; Rail Vehicles and Safety & Security; and Rail Operations (see Table 2 for details). The lectures were up to date and based on the results of the most recent rail research, as most of the lecturers are also involved in various rail research projects at national and international levels. Mentoring and discussion sessions took place at the end of each day, offering an opportunity for students to ask questions and digest the content of lectures presented throughout the day. Learning through research activities took place in Week 2 of the program. Students were grouped into small multinational and multidisciplinary research teams led by project supervisors and had five working days to conduct research into a previously selected rail-related topic. The topics focused on various issues such as Urban Freight Movement by Rail, Efficient Energy Use for Sustainable Rail Transport, and Analysis of Rail Yard and Terminal Performances. Each student was given access to a computer with an Internet connection, international research databases, and scientific journals. Each research team was expected to produce a report as well as a poster, both based on the outcomes of their research work. In addition, each team delivered an oral presentation of their research findings at the end of Week 3; each team member was obliged to take an active part in the presentation's delivery. Apart from the research seminars, Week 3 also included technical visits to rail facilities (e.g., metro depot, railway museum), interactive workshops, and networking lunches with representatives from railway industry attending.

Table 1. Number of participants representing countries from HEI partners.

Countries represented by HEI partners	2012	2013	2014
Belgium	1	0	0
Bulgaria	6	6	6
Greece	6	0	0
Germany	6	4	3
Italy	6	6	6
Poland	0	7	6
Portugal	6	6	6
Romania	6	7	6
Thailand	0	16	0
Turkey	6	7	6
UK	6	5	4
Other	0	2	0
Total sample size	49	66	43 *

Note: * Three respondents did not fill in the feedback questionnaire; therefore, the sample analyzed for 2014 is 40.

Table 2. Thematic areas of lectures delivered in Week One of the program.

Day	2012 Lectures	2013 Lectures	2014 Lectures
1	Logistics and Supply Chain Management	Logistics and Supply Chain Management	Rail Transport, Logistics, and Supply Chain Management
2	Rail and Multimodal Transport	Multimodal Transport and Energy	Rail, Multimodal Transport, and Energy
3	Rail Infrastructure and High Speed Rail	Rail Infrastructure, High Speed Rail, and ITS	Rail Infrastructure, High Speed Rail, and ITS
4	Vehicles, Environment, and Safety	Rail Vehicles, Safety, and Security	Rail Vehicles, Safety, and Security
5	Rail Operations, Timetabling, and Control	Rail Operations, Timetabling, and Control	Rail Operations, Traffic Control, and the Environment

Notes: Source: [6].

4. Methodology

4.1. Questionnaire Design

As the intensive program was co-funded by the EU, the organizers were obliged by the sponsor to collect feedback from participants of the program using a standard feedback template. The template was a four-page A4-size document split into seven sections dedicated to: student details, identification of intensive program and motivation, information and support, accommodation and infrastructure, recognition, costs, and evaluation of the intensive program. In addition, 11 new questions directly related to the intensive program were designed by the organizers and listed on a two-page supplement to the standard template form. The extra questions were related to evaluation of specific activities in Weeks 1, 2, and 3, as well as to barriers in communication, evaluation of materials received, overall positives and negatives of the program, suggestions for improvement, and feedback on how participation in the program might influence students' future career plans. The final version of the feedback form was a six-page document, which was used for data collection in 2012, 2013, and 2014.

4.2. Data Collection

At the end of each edition of the intensive program the six-page feedback form was distributed in a hard copy to all student participants. On the last day of the program the students were given a block of time to complete the questionnaire individually and they were obliged to return it to the organizers. No electronic or online feedback was collected. In addition, each year a few selected students were asked to give a short oral interview and share their experience about the program. The selection was based on the students' interest and activity observed by the organizers during the duration of the program. Unstructured interviews were conducted by student assistants working with the organizers on the program's delivery. All interviews were transcribed and remain at the organizer's disposal.

4.3. Socioeconomics of the Sample

The socioeconomics of students participating in each of the editions vary in terms of numbers, nationalities, academic backgrounds, and male:female ratio. However, each year the participants completed a similar feedback survey, which allowed for a fair comparison of the teaching and learning outcomes achieved. The number of participants was 49 in 2012, 66 in 2013, and 40 in 2014; Table 1 presents the numbers of students from each of the countries represented. A majority of students attending the program were final-year undergraduates (BEng or BSc) or postgraduates (MEng, MSc and PhDs) selected by the partners and approved by the coordinator. The prospective students had to pass a number of the partners' internal criteria before they were admitted to the program. The criteria included a good level of English, proven interest in the railways, and a good academic performance. In addition, 16 academics from Thailand participated in the 2013 edition of the program and their responses were combined with the students' responses for 2013. Also, a number of one-to-one interviews with the program's alumni were conducted over the three years in order to learn more about their experience and benefits gained. Quotes from these follow-up one-to-one interviews are used to support the results presented in the paper.

5. Analysis of Academic Outcomes

The final feedback questionnaire distributed at the end of each edition of the program was a six-page document with questions related to academic and personal outcomes achieved, the structure of the program, and suggested areas for improvement. An analysis of the structure and organization of the program is presented in detail in [6]. An analysis of results related to the academic outcomes and benefits to participants attending the intensive program in rail and logistics are presented in this paper. The analysis sections are split by weeks and activities offered and include an analysis of feedback related to: lectures in Week 1, research work in Week 2, and technical visits, workshops, and seminars in Week 3. In addition, participants' overall satisfaction with academic outcomes is also compared for 2012, 2013, and 2014. Also, additional non-technical benefits gained by the participants are briefly described.

5.1. Lectures

The first week of the program was a series of lectures given by European professors and experts through the day and discussions and mentoring moderated by a facilitator in the evening.

5.1.1. Ratings

The students were asked to rate lecture days taking place in Week 1 of the program. They were given five options to choose from, with "Very Poor" being the most negative and "Very Good" being the most positive answer. No additional qualitative feedback was collected on this topic, although there was an extra space at the end of the questionnaire for additional comments.

Table 2 shows thematic areas covered by lectures delivered in Week 1. It can be seen that they remain largely the same, with only small variations on topics. This similar structure of Week One allows for a fairly accurate comparison of lecture day ratings by participants of the three editions of the program to be made.

The results displayed on Figure 1 show that the mean ratings for all editions and all days are around 4, which is "Good". The second and third day of teaching activities received the most positive ratings overall, with the 2013 edition reaching the mean of 4.53 for lectures on rail infrastructure delivered on day three. However, it is clearly seen that the 2013 edition had much more positive scores than the other two editions. The reason for these positive scores might be the large group of Thai academics, who were very positive about the program. As they attended the program with the mission of updating their knowledge and skills, which will be implemented in their home country when teaching similar rail-related subjects in the near future, they were obviously interested in getting as much as possible out of the lectures. This group of participants raised the majority of questions in discussion time and overall directly benefited from the knowledge shared with them in Week 1. Therefore, the scores for the 2013 edition are overall much more positive than the scores for the 2012 and 2014 editions.

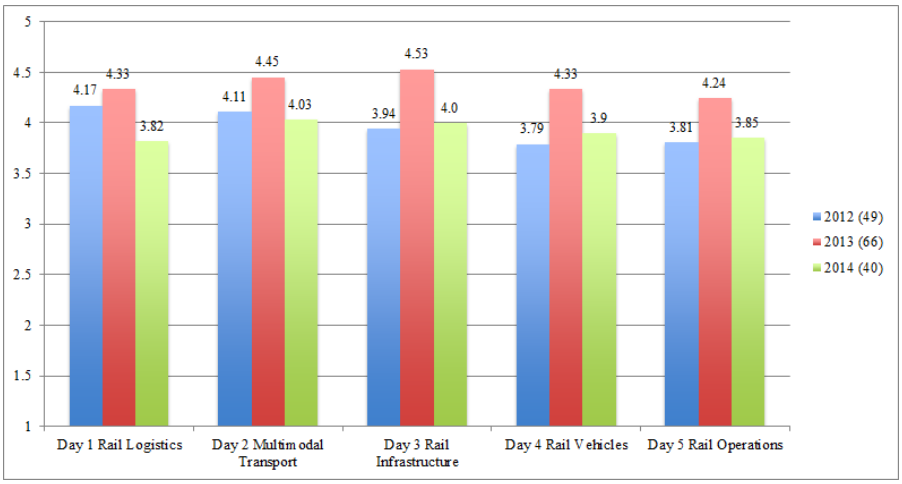

Figure 1. Mean ratings for lecture days in Week 1.

On average the highest rated lecture day was Day 2, which consisted of "Rail, Multimodal Transport and Energy" topics. This has been a consistently positive day, ranking in the top two for each year, although in 2014 it was at its lowest mean rating despite being the highest for the third edition. In 2014 an overwhelming majority of 77% of the students found Day 2 to be "Good" or "Very Good". Day 3, the most popular day in 2013, had the largest drop in rating, moving from a mean rating of 4.53 down to a mean of 4.00 in 2014. Although this is the largest drop for the day as a whole, the ratings remained largely positive and other days, such as Day 1 with a drop of 0.51 in 2014 in comparison to 2013, should be the greatest concern for the organizers in light of the benefits offered to participants. Nevertheless, based on individual talks and oral feedback received from students, the fluctuations in mean ratings for each of the lecture days might be connected with changes in the staff delivering the lectures each year. As the partner HEIs involved in the delivery of the program changed slightly every year, in some cases the same topics (e.g., Supply Chain Management in Day 1) were delivered by different individuals in different editions. These changes could have influenced overall content and delivery style of each lecture as well as overall perception of each lecture day in various editions. However, further analyses of available data would have to be introduced to investigate this topic in greater detail.

5.1.2. Favorite Lecture

As Week 1 was loaded with lectures delivered by various rail professionals and rail academics, it was of interest to identify the most popular thematic areas amongst the students. Participants were asked, in an open-ended question, to name the lecture, lecturer, and thematic area they enjoyed most during Week 1 of the program. As there were 25 lectures in total delivered in Week 1, the responses given were grouped into 12 thematic areas (e.g., Day 4 on Rail Vehicles included lectures on Rail Vehicles and Safety and Security). Figure 2 shows the results for all three editions of the program.

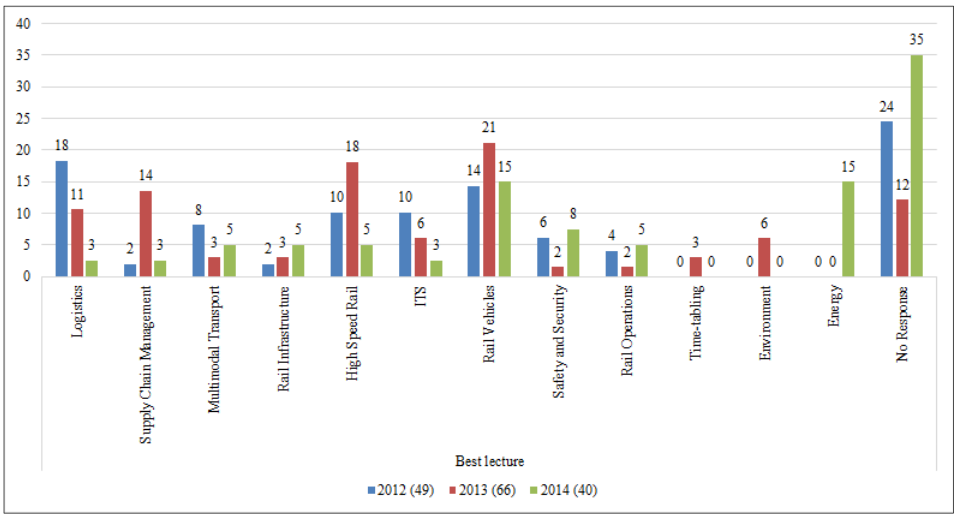

Figure 2. Most popular lectures [%].

Throughout the three editions of the program, the most popular thematic area was Rail Vehicles, with up to 21% of students in 2013 selecting a lecture on this topic as the best. Also, High Speed Rail and Logistics proved to be popular amongst the participants, although the latter, delivered by a different individual in each edition, experienced a significant drop from 18% in 2012 to 3% in the 2014 edition. All other votes were spread across the remaining thematic areas, as shown in Figure 2. Interestingly, the Energy topic, which was delivered by the same lecturer throughout the three editions of the program, gained popularity in 2014 as 15% voted for it as being the best lecture. As this spectacular growth in the popularity of the Energy lecture cannot be explained by a different individual delivering the lecture in different editions, other reasons must be found to explain this behavior.

Although the reasons for the above selections were not followed up in the questionnaire, it should be highlighted here that the survey looked into identifying the best and most enjoyable lecture. Therefore, a number of issues could feed into this perception, including an interesting topic in general, a good speaker, and the changing preferences and interests of the program's participants, whose backgrounds also varied each year. It is not clear what exactly students had in mind when answering this question, but the results for each thematic area remained at a similar level for the three consecutive years, with Rail Vehicles earning the highest scores overall. Despite those doubts, the question was not changed and the two reasons for that are: data format consistency (the question was asked in the same way throughout the three years of the program) and the form's space limits (it was intended to keep the questionnaire as a six-page template with no extra space for new questions or explanations).

5.1.3. Summary of Week 1 Activities

Overall, the ratings for lectures delivered in Week 1 of the program were positive, although a number of improvements for the future could be identified. Firstly, when asked if more lectures would improve the program in the future, only a minority of 15% of respondents answered "Yes" in 2014. This result is down from 2013, but only by 5%. Secondly, 67% of participants in 2014 said they believed more discussions would help improve the program; this is up from previous years, as in 2013 it was about 50%, and demonstrates a growing desire to have more engaging sessions rather than overloaded lecture days.

Thirdly, some participants, particularly from Portugal and the UK, claimed that a lot of the lectures were at a very basic level and because of that they were unable to improve their rail-related knowledge much. One of the UK male participants of the 2014 edition, in a follow-up interview, said:

> "It [the program] is not as technical or as in depth as you would have liked but it gives you a brief overview of all the subjects, which is a good thing" [10].

A few participants found there were too many lectures condensed in Week 1 and found it difficult to stay in the classroom for the duration of five lectures a day, despite breaks of at least 15 minutes between the lectures. Finally, those less fluent in English also said that they found some of the lecturers difficult to understand because of their strong accents. In contrast, some feedback comments spoke of a passion and genuine interest for the lectures, which at the end inspired and benefited the participants.

5.2. Research Projects

Week 2 of the program was dedicated to research projects, with the goal of improving participants' academic and non-academic skills. The academic skills included a review of the relevant literature on a chosen topic, selection of an appropriate methodology for a chosen project, a new knowledge on a selected topic, scientific writing, *etc*. The non-academic skills included communication skills, work in a multicultural environment, English language improvement, *etc*.

The students were split into research groups of mixed nationality and discipline, with between four and six members each. Each group was given a different area to research independently and had at least one supervisor who was an expert in the field to guide them. Meetings with the supervisors took place on the campus or remotely, depending on supervisors' availability. The participants were asked to rate different aspects of the Week 2 based on a five-point scale, with 1 being "Very Negative" and 5 being "Very Positive".

5.2.1. Academic Skills

By the end of Week 2 each research team was expected to produce three group deliverables: a research report, a research poster, and a presentation, which they then delivered and displayed with an audience of their peers and industry experts in Week 3. In addition, after each edition of the program all research reports and posters produced were published online on the program's website and exceptional projects were selected by supervisors for scientific publication [11–13].

The participants were asked to give a rating in three areas that personally impacted and benefited them on the second week: "Interest in Topic of Research Project", "Improved Knowledge of Rail and Logistics" and "Project Ideas Valued by Team".

Figure 3 shows that there has been a rise from 2013 in the students' interest in the topic but it does not reach the levels of 2012. However, the result is still above "4" (a positive rating), so overall the interest was high and the participants found the second week worthwhile.

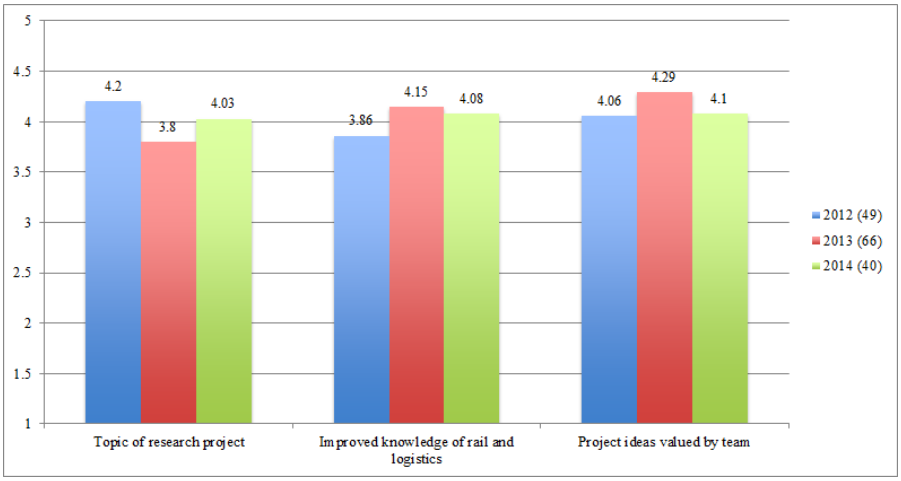

Figure 3. Mean rating of the personal experiences of the scientific aspects of Week 2.

The "Improved Knowledge" impact saw a slight drop in 2014 compared to the 2013 results (4.08 *versus* 4.15); however, this drop is very small and shows that the area has some consistency from the previous year. Participants clearly benefited from improved knowledge on a given subject.

Finally, a majority of participants agreed that their teams valued their project ideas. The responses to this question were fairly positive, leaving it with a mean of 4.08 for 2014, which was below that of 2013 (4.29) but above 2012's result (4.06).

On the whole, participants had a beneficial personal experience in Week 2 of the program. For all three questions the mean response was above "4", showing that the majority of students perceived the group task positively and it improved their academic as well as their team work abilities.

5.2.2. Non-Technical Skills

Students were asked to rate how they felt their "English Language", "Communication Skills" and "Cultural Understanding" had improved over the second week. Figure 4 shows the mean ratings of the outcomes that students gained while working on their research projects.

The results obtained show that, for the three consecutive years, the second week has helped greatly in improving students' English ability. In 2014 it was at an all-time high with 55% of the participants "Very Positive" about how the group project had helped to improve their English; the mean rating reached the level of 4.35 on a five-point Likert scale.

When asked about how their communication skills had improved because of the second week's activities, the students again responded very positively, with a mean rating above "4" and reaching 4.40 in 2014. The 2014 participants were considerable more happy with how their language and communication skills had improved in comparison to the 2012–13 students. In fact, no one evaluated

the benefit to themselves as being below average and 85% of the participants thought their experience was "Positive" or "Very Positive".

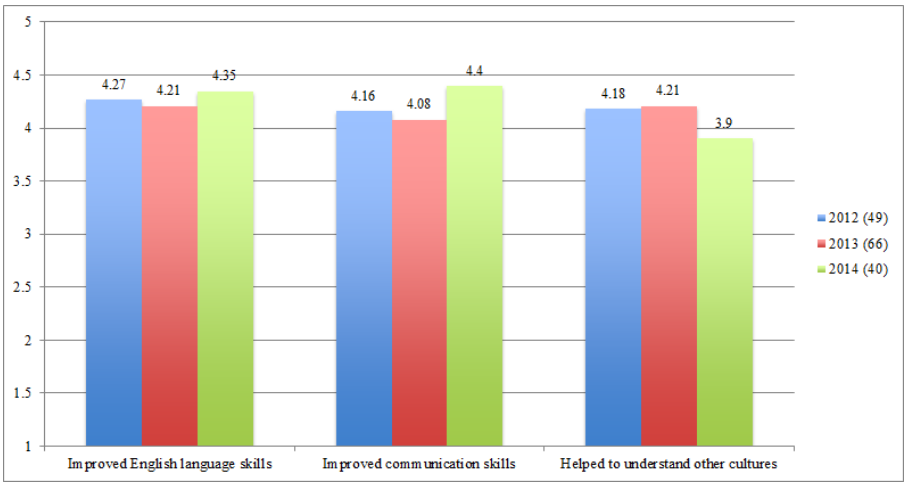

Figure 4. Mean rating of the personal experience of the outcomes of Week 2.

The benefits in terms of improving communication skills in a multicultural environment were also reinforced during the one-to-one interviews. Participation in the program, where a multicultural and multidisciplinary environment was at the center of all activities, clearly helped a number of people with their job applications. As one of the Portuguese male participants of the 2012 edition, who later got a job in the UK rail industry, said:

> "The program shows that you have an international experience, it shows that you can cooperate with people from different backgrounds, I think that is something that employers value" [10].

A similar statement was also expressed by an Afghan male participant of the 2013 edition representing Turkish HEI, who applied for a placement with a large UK rail project company:

> "When they checked my CV, which indicates I have attended the intensive program in rail and logistics, they called me for an interview" [10].

The benefits of the multicultural aspect of the program were highlighted on the questionnaire, in one-to-one interviews, and in informal chats with the participants. The students, like a German female participant of the 2014 edition honestly admitted that it was one of the reasons why they attended the program:

> "Meeting different people from all over Europe is a special experience, so that's why I have chosen to do this program" [10].

Another non-technical skill promoted during the program was the ability to work in a team. Although students' feedback on research teamwork helping them understand other cultures better was very positive in the first two years (with an average of 4.18 and 4.21, respectively), it dropped to a mean of 3.90 in 2014. This is particularly interesting as the other questions in this category were overwhelmingly positive for 2014. In the same edition, 30% of respondents rated teamwork's aid in understanding cultures as "Neutral" or below. The comments left by the participants yield no information as to why this large drop

occurred; in fact, many of the comments say things such as "Being with multicultural people…working together" to describe what was good about the program. No other qualitative questions that could have helped us to understand the results better were included in the questionnaire. However, one of the explanations for this drop could be personality clashes within some of the research groups, which were observed on a small scale by the organizers in Week 2. Despite those incidents, a positive outcome in terms of the overall inspiration that the program brought was expressed by one of the Romanian male participants of the 2014 edition, as follows:

> "I want to work harder, having been able to compare my home country's system to the UK's system. I am inspired to work harder and be part of the team who will improve my own country's railway to excel on a global scale" [10].

5.2.3. Support

Week 2 of the program was dedicated to independent team research work; therefore, feedback was sought on the support received during that week. The support was considered in terms of access to the university library, access to computer clusters on campus, and finally the level of support received from project supervisors.

The first question asked in the 2012 and 2013 editions was about the library access received; however, in 2014 students were unable to access the library so this question was not applicable. Results are displayed in Figure 5; they show mean ratings based on a five-point scale, with 1 being "Very Unhappy" and 5 being "Very Happy".

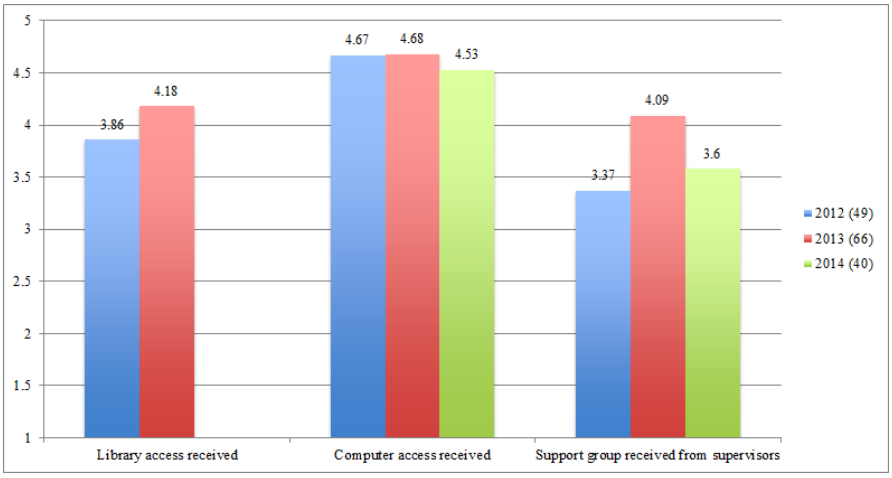

Figure 5. Mean rating of the personal experience of support given during Week 2.

The next question asked participants to rate the computer access received. The results for all editions of the program were very positive, with a mean rating of 4.53 in 2014. Overall, nearly 90% of respondents said they were "Happy" or "Very happy" with the IT access provided during the research week.

As each research team had at least one supervisor delegated to work with in Week 2, feedback was sought on students' perception of their team-supervisor collaboration. Therefore the students were asked to evaluate their personal experience based on the support provided by project supervisors during their

project work. The mean of 3.58 in 2014 is a drop from the 2013 results; however, it is still an improvement in comparison to the 2012 results (3.37), which had some considerable problems. Although some comments in the 2014 questionnaire mentioned issues with supervisors' availability, the majority of the participants seemed pleased with the support they got throughout the research week.

5.2.4. Summary of Week 2 Activities

When asked if more time for research projects would be an improvement, the majority of students agreed (75% in 2012 and 67% in 2014). This shows that many enjoyed the research projects but that some (between 21% in 2012 and 32–35% in the next two editions) struggled to find all the information required and finalize their projects in the short time frame. Figure 6 shows that the desire for more time for research projects continues, although at least one quarter of participants seemed to be happy with only five working days dedicated to project work.

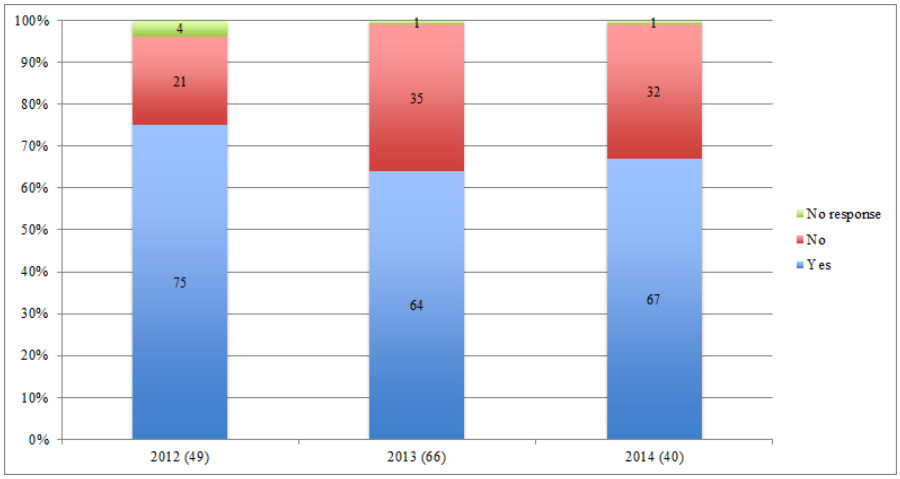

Figure 6. Would more time for research projects be an improvement? [%].

Despite the desire to spend more time working on research projects, the students were able to produce research of good quality by the end of each edition and some were selected for scientific publication. Publication certainly benefited the students and gave some of them a unique opportunity to put this achievement on their CVs. As one of the Greek female participants of the 2012 edition summarized:

> "I put [the program] in my work resume…I think it is one of the reasons I got selected for this internship. It is really impressive…My employers wanted to know more and read my paper [published as a result of the research project]" [10].

5.3. Technical Visits and Workshops

The program activities in Week 3 were split into technical visits followed by afternoon workshops concentrated on Monday and Tuesday and thematic seminars with a poster exhibition and networking lunches on Wednesday and Thursday. Table 3 presents details of the technical visit destinations and workshop topics.

Table 3. Technical visits and workshops included in the program.

Activity		2012	2013	2014
Technical Visits	Day 1	Visit to Tyne and Wear metro depot	Visit to Tyne and Wear metro depot	Visit to Tyne and Wear metro depot (CANCELLED)
	Day 2	Visit to Beamish Museum	Visit to National Railway Museum in York	Visit to Port of Tyne
			Visit to Network Rail offices in York	Tour of Newcastle
Workshops		Rail in urban areas	Train operators (undertakings) *vs.* infrastructure managers	No workshops, but extra time given to complete research projects
		History of railway transport by continents and regions	History of railway transport by continents and regions	History of railway transport by continents and regions

5.3.1. Ratings

Students were asked for feedback on the activities in Week 3 and rated them on a five-point scale, with 1 being "Very Poor" and 5 being "Very Good". As shown in Figure 7, the latter part of the week was received a lot better than the technical visits. Figure 7 shows the results for the technical visit to Tyne and Wear metro depot. This visit took place in 2012 and 2013 only; in 2014 it was cancelled at the last minute due to an accident on the metro line. Nevertheless, the results for 2012 show a wide spectrum of opinions about the trip, with only 42% rating it as "Good" or above. However, in 2013 the results improved dramatically; this is probably due to the fact that the delivery method of the technical visit changed. More specifically, in 2013 more metro depot staff members were involved in delivery of the tours in small groups, and they were followed by a Q&A session, attended by engineers, afterwards. Those changes proved to be beneficial for the participants' learning and enjoyment and, as Figure 7 shows, ratings of "Average" or below for the 2013 edition are marginal (8% in total).

In 2014 there were two new activities introduced: visit to Port of Tyne (places were limited and only 29 students attended) and a guided tour of Newcastle (with 16 attendees). The latter activity received much more positive responses (44% of participants rating it as "Very Good") than the mixed feedback for the port visit (from "Very Poor" to "Very Good"). It must be explained here that both activities took place on the same very rainy day and students attending the visit to the port traveled by metro, which was flooded on the day and caused major transport disruptions in the area.

Consistently through all three years there has been a positive response to the final activities of Week 3: thematic seminars and a research poster exhibition. As shown in Figure 7, 20% or more of students deem the final activities of Week 3 "Very Good". Moreover, a majority of students in 2014 found each of the activities in Week 3 to be "Good" or "Very Good". This reflects strongly on these final days, as it would be easy for students to become bored or agitated as the concluding day approaches.

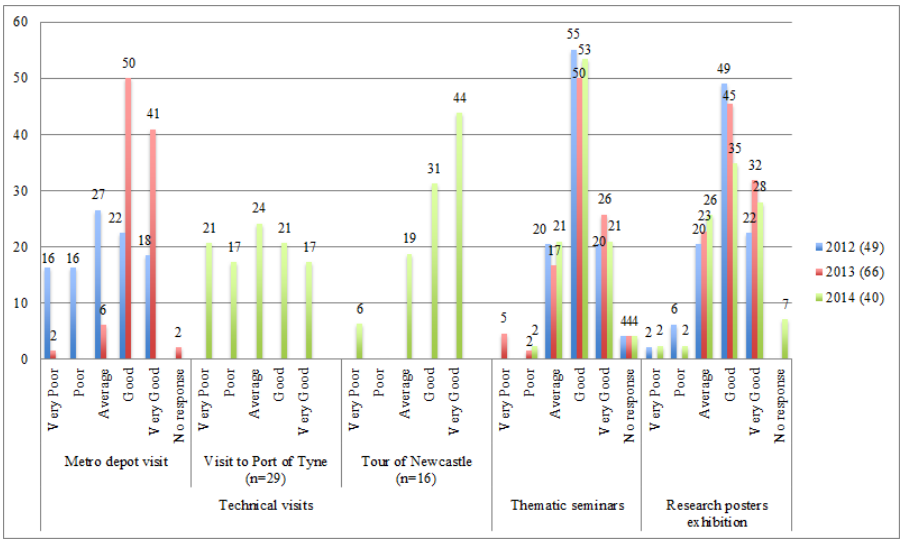

Figure 7. Ratings for selected activities of Week 3 [%].

5.3.2. Summary of Week 3 Activities

Overall, ratings for activities in Week 3 were mostly positive, which allows us to come to the conclusion that students were content with the activities offered by the program in the third week. In addition to the feedback on technical visits, workshops, thematic seminars, the poster exhibition, and networking lunches, the participants were also asked whether they believed more technical visits would improve the program. As shown in Figure 8, in 2014 86% of students thought that the program could be improved by having more technical visits, an increase on the results from 2013.

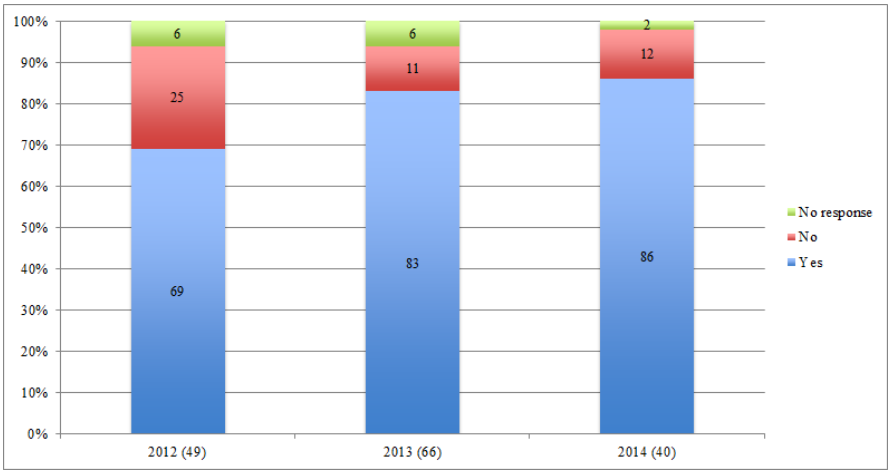

Figure 8. Would more technical visits improve the program? [%].

To summarize, Week 3 was a positive experience for the participants of all three editions of the program. However, the data increasingly point to a desire for more technical visits. Perhaps improving the existing technical visits on offer with new destinations could be a consideration for future editions of the program.

5.4. Satisfaction with Academic Aspects

The students were asked about their satisfaction with a number of different academic activities and pedagogical aspects of the program. They were asked to rate each one on a scale from 1 to 5, with 1 being "Not at all satisfied" and 5 being "Very much satisfied". Figure 9 displays bar charts with the mean response for the 2012, 2013, and 2014 participants.

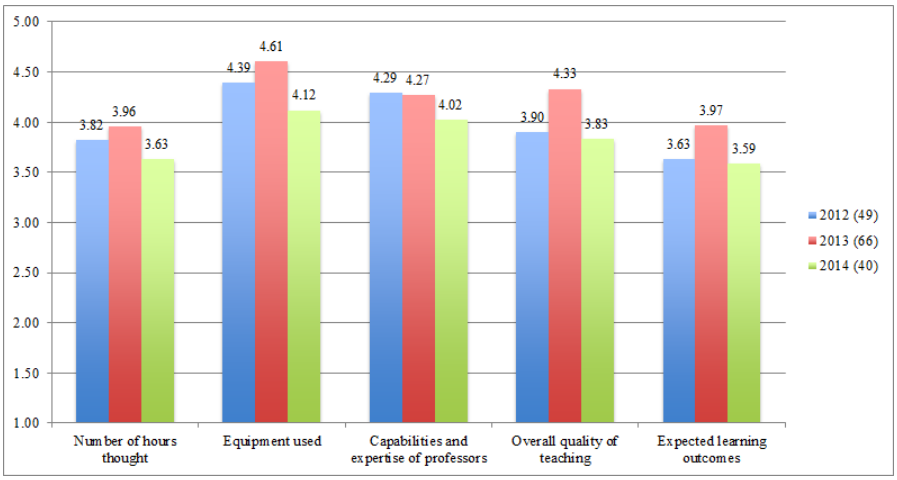

Figure 9. Mean rating of how satisfied participants were with the academic and pedagogical aspects of the program.

Like both 2012 and 2013, the lowest rated aspect for 2014 was the "Expected learning outcome"; 2014 achieved the lowest results of all, being on average 3.59, which is just below a "Satisfied" response.

When compared to 2013, the mean ratings have all fallen in 2014 but most have only fallen by a small amount and the general trend has remained the same with "Equipment Used" and "Capabilities of Professors" giving two the most positive results (with mean values of 4.37 and 4.19, respectively).

However, "Quality of teaching" in 2014 experienced a drop in comparison to the previous editions. This decrease is likely due to the Portuguese students (Master's level), who complained that the lectures were too basic for them and gave an average rating of 2.83 to this item. On the other hand, students from Italy (BEng level) responded with an average of 4.50 for the "Quality of teaching", which shows a wide spectrum of expectations expressed and feedback received for the teaching and supervisory activities.

In order to improve presenters' teaching and provide constructive feedback, after each of the editions of the program, the results of the students' surveys were shared with the teaching staff involved. However, the program relied on human resources available at HEIs involved in the project and in-kind contribution of professors to the program. No formal assessment of European professors' teaching abilities was conducted. This was also due to limited funding for the program, which covered only travel and subsistence for the participants; no staff costs were allowed to be claimed from the project.

5.5. Summary of Academic Outcomes

As the main objective of the program was to improve railway knowledge exchange between European institutions, the students were asked to judge the academic outcomes of the program. A five-point scale

was employed for this exercise, with 1 being "Very Poor" and 5 being "Very Good". Figure 10 shows the results for academic outcomes for the three editions of the program.

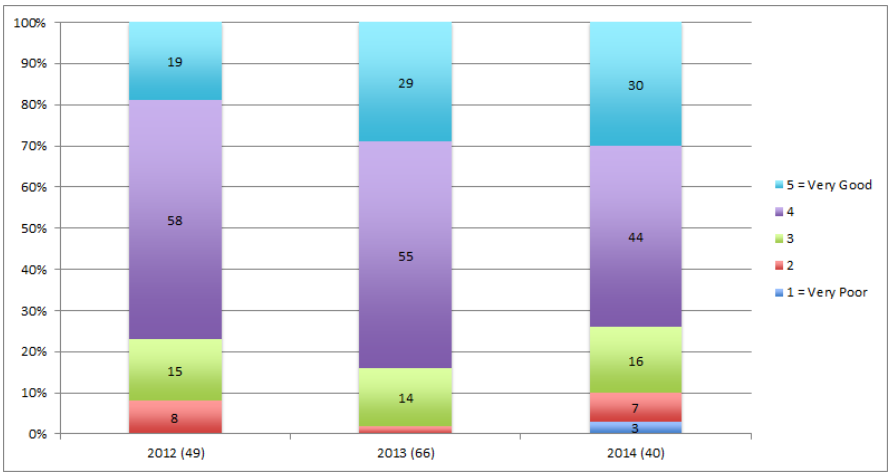

Figure 10. Judgement of academic/learning outcomes of the program [%].

For the three consecutive years, the majority of participants rated their academic/learning outcomes as "Good" or "Very Good". In 2012 77% of students rated the program as at least "Good"; this rating remained at a similarly high level for the next two editions (84% in 2013 and 74% in 2014).

Overall, the academic outcomes have been generally positive, with most students satisfied with the quality of teaching as well as other aspects that helped them academically. The primary issue was the uneven spread of students expecting more challenging and advanced lecture topics *versus* students being pleased with the lectures' content. This result was influenced by the fact that participants represented various levels of higher education with more (MEng students and lecturers from Thailand) or less (BEng students) advanced technical knowledge in the field of railways.

6. Conclusions

Analysis of participants' feedback on the academic outcomes of each of the three editions of the intensive program in rail and logistics showed a number of benefits to the participants as well as a few areas highlighted for improvement in future editions.

Firstly, the participants were generally positive about the activities offered in Week 1, with Day 2 and Day 3 lectures rated the highest on average. This result shows that the lectures on multimodal transport and rail infrastructure were well delivered and participants benefited most from spending these days of Week 1 in a classroom. Moreover, the results for the second edition in 2013 are higher than in other editions; this is due to extremely positive lecture ratings from the Thai academics. A mixed audience composed of rail beginners and professionals attending the same set of lectures, like in 2013, might be risky in the future as participants' background knowledge and expectations might be different.

Secondly, participants perceived the research work conducted in Week 2 to be a positive thing. A majority of the students noted a number of academic and non-technical skills gained as they not only improved their scientific knowledge and skills but also benefited personally from working in a multicultural and multinational environment. However, some participants expressed an opinion that Week 2 group activities proved to be challenging as cultural and personal differences were experienced.

Although this is not an area of major concern, it might be worth highlighting to prospective participants the multicultural and multidisciplinary nature of the railway program.

Finally, technical visits and thematic seminars taking place in Week 3 were generally perceived as positive activities. Nevertheless, from conversations with students and oral as well as written feedback received, it was concluded that the activities in Week 3 could be strengthened by perhaps offering other alternatives to the current technical visits and delivering more interactive and engaging workshops.

7. Recommendations

7.1. Recommendations for Improvement

Based on the evaluation of the benefits to students of participating in the rail-focused program presented in the paper, a number of recommendations for improvement for future extracurricular academic activities have been identified.

Firstly, in terms of the academic content of the program, an updated and flexible curriculum, with optional lectures and workshops at various levels, would allow prospective students to adjust the level of the program to their needs and experience. This would then translate into greater student responsibility and involvement in the curriculum as well as increased satisfaction with the actual content studied. The flexible curriculum could also attract new target groups from university students and industry.

Secondly, in terms of the benefits related to gaining new soft skills such as improvement in English language skills, communication skills, or teamwork skills, more attention could be paid to the way in which small working groups are formed and to progress moderation, whereby mentors could be obliged to actively participate in their groups' work. Also, more social activities in the evenings or weekends, even if optional, would facilitate a smoother integration of the students outside of the classroom, which then helps with academic activities too.

Finally, the structure of the program could be slightly changed to allow more time for discussion in Week 1 and extra time for research in Weeks 1 and 3. These changes would facilitate a quicker integration of students in Week 1 and a smooth transition from lectures to research projects. In addition, more technical visits to rail sites would be of benefit to the students who respond well to hands-on experience and face-to-face contact with the industry, which helps them to better understand the variety of roles in the rail sector and prospective career options.

These suggested improvements to the overall program could help ensure that the railway knowledge and new skills intended come across to the participants and could help maximize the benefits gained by students participating in extracurricular academic activities.

7.2. Further Research

Research into the benefits to young rail enthusiasts of participating in extracurricular academic activities, as presented in this paper, is an opportunity to evaluate the existing intensive program in rail and logistics and share good practice. However, much more can be done to enrich our knowledge of the benefits any additional rail-related activities can offer to students in relation to their academic as well as personal experience. The following avenues for further research have been identified.

Firstly, it would be of interest to the program's organizers to follow up with the program's alumni and investigate their career progression and the impact (if any) that the rail program had on their job prospects. This would then allow for showcasing examples of the impact the activities had on students' lives, helping to attract prospective students from universities as well as industry in the future.

Secondly, it would be beneficial to study in more depth similar extracurricular academic activities with a railway flavor (summer schools, placements, workshops, challenges, *etc*.) addressed to university as well as pre-university students. This would then allow for a comparison of various teaching and learning methods used by the activities' organizers, but most importantly it would allow for evaluating activities' outcomes and students' feedback in order to advise future activity organizers on best practices.

Finally, it would be beneficial to investigate students' expectations and needs related to extracurricular rail activities, as well as rail industry perspectives, and the benefits they are hoping to get from their participation in rail-focused activities either as contributors (e.g., sponsors, lecturers, mentors, visit hosts) or participants (students). This knowledge would then allow organizers to shape the program's curriculum to the expectations of both parties and increase the attractiveness of future editions of the program.

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Author Contributions

Anna Fraszczyk contributed to the paper by combining the available analyses and writing the final version of the work. She also co-supervised the work of Joseph Dungworth during his four-week summer placement at NewRail. Joseph Dungworth helped with data cleaning and processing as well as conducted comprehensive analyses of the data for three editions of the program. He also wrote an internal report combining analyses of organizational data, personal and academic outcomes which was used as a starting point for this paper. Marin Marinov was the initiator and coordinator of the intensive program who co-supervised Joseph Dungworth and reviewed the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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